component. The experimental results stand whether or not the cost/benefit claim or the epistemic claims are correct.

An alternative, weaker but more probable, cost/benefit claim is that religious belief is more worthwhile than unbelief, even though we do not know whether or not God exists. This alternative requires only empirically based assumptions. Since, as I shall maintain, the authors' arguments for the epistemic component are quite problematic, I suggest that they use Ockham's razor to eliminate that component and replace it with the weaker alternative.

According to A&N, religious beliefs concern supernatural beings, immaterial personal agents active in our material world. Maintaining the universality of this version of the transcendent, they brush aside the concern that this interpretation of the transcendent fails to do justice to major religious traditions. Major portions of Hinduism and Buddhism, as well as the mystical branches of all the major religious traditions, either have a nonpersonal conception of the divine or do not distinguish, as do the authors, between the transcendent and finite self. A&N compound this neglect by failing to examine mysticism as a source and justification of religious belief. In addition, the authors lump together without justification the beliefs of all supernaturalistic religious traditions, from primitive to culturally advanced, and make no distinction between folk and disciplined practices of the epistemic assessment of religious beliefs.

Set aside these inadequate characterizations of the *explanandum*. On the authors' view, beliefs about the supernatural have multiple epistemic faults rendering them unjustified and false. They lack truth conditions, are contradictory, cannot be logically or empirically validated, are inconsistent with factual knowledge, and violate the categories of our evolutionarily based cognitive capacities concerning folkmechanics, biology, and psychology.

But these critiques conflict with each other. Expressions that lack truth conditions are incapable of truth or falsity and are cognitively meaningless. As such they are not candidates for A&N's *cognitive* explanatory hypothesis. Nor can they be either contradictory or empirically false, since such expressions can be so only if they have truth conditions that they fail to satisfy.

Accordingly, it seems best to interpret A&N's claims that religious beliefs lack truth conditions, to mean that even though religious beliefs possess truth conditions, they fail to satisfy them. However, the authors suggest two conflicting ways in which cognitively meaningful supernatural beliefs are false; that is, they cannot be logically or empirically verified or falsified. If, as the authors maintain, beliefs about the supernatural are contradictory, then they are logically false and logically falsifiable. However, if religious beliefs are logically false, then they are not subject to empirical verification or falsification.

However, A&N's references to supernaturalistic beliefs as "inconsistent with fact-based knowledge" and "minimally" violating claims formulated in terms of our evolutionarily acquired cognitive capacities, suggest that in their view such claims are empirical and empirically testable. But, if that is so, then such claims can be empirically true or false. And if false, as A&N claim, they are so empirically.

A&N's major argument for the empirical falsity of religious claims is that they violate or minimally exceed the limits of claims formulated in terms of folk mechanical, biological, and psychological categories. They contrast legitimate scientific and illegitimate religious metaphorical extensions of the categories of our folk mechanisms, and claim that in the sciences there is an attempt to get rid of the metaphor and to assimilate the claims to factual and commonsense beliefs. But Newtonian mechanics demonstrates that only accelerated bodies require a force, whereas Aristotelian folk mechanics require a cause for all local motion, accelerated or not. Folkbiology requires that adaptations be designed, but evolutionary biology does not. Arguably, cognitive psychology and cognitive neuroscience are beginning to make do without folkpsychology. Quantum mechanics, relativity theory, electrodynamics, and molecular biology, to name but a few well-grounded scientific theories, depart even further from our evolutionarily based cognitive capacities. A&N owe us some principled reason why departure from common sense is fatal to religious, but not scientific, claims. Moreover, philosophers of science have shown that the import of theoretical terms cannot be reduced to observational meanings without the loss of significant meaning. The issue for scientists is not to show how metaphorically elaborated theories, for instance, the planetary orbit model of the atom, can be understood in literal (commonsense) terms. Rather, it is to reveal how such theories have, or fail to have, empirical connections with recordings of instruments, themselves built on the basis of theories. If supernaturalistic claims are to be shown to be unjustified empirically because they fail to meet the epistemic standards of the sciences, then the authors need to show us where and why this happens.

A&N have not adequately supported the epistemic component of their proposal. A weaker hypothesis is available to them which does not require their negative assessment of the epistemic status of supernaturalistic beliefs. I counsel them to use Ockham's razor and eliminate it. Both alternatives, however, require that the authors support their cost/benefit estimates about religious belief.

Cognition and communication in culture's evolutionary landscape

Mark Schaller

Department of Psychology, University of British Columbia, Vancouver, British Columbia, V6T 1Z4, Canada. **schaller@psych.ubc.ca**
http://www.psych.ubc.ca/~schaller/schaller.htm

Abstract: Atran & Norenzayan's (A&N's) analysis fits with other perspectives on evoked culture: Cultural beliefs might emerge simply from the fact that people share a common cognitive architecture. But no perspective on culture can be complete without incorporating the unstoppable role of communication. The evolutionary landscape of culture will be most completely mapped by theories that describe specifically how communication translates evolved cognitive canals into cultural beliefs.

There are few systems of belief and behavior so prototypically *cultural* as those that define a religion. Just as religion may be a predictable by-product of a canalizing evolutionary landscape, many other features of human cultures can also be best viewed as accidental by-products of specific psychological dispositions that emerged for very different reasons altogether. As others (e.g., Tooby & Cosmides 1992) have suggested, in order to crack the complicated code we call culture, we would be wise to first figure out the specific cognitive canals carved by our evolutionary past.

Atran & Norenzayan (A&N) apply this approach cleverly; the useful upshot is a penetrating perspective on several paradigmatic elements of religion. Others may take a broader view of religion and wonder whether an evolutionary canalization approach can also explain the kinds of moral injunctions that show up in, say, the Ten Commandments. It can. Krebs and Janicki (2004) describe how specific evolutionary pressures inclined the human mind toward specific kinds of moral norms. These norms may be codified in somewhat different ways in different religious systems, but the norms themselves appear to be universal. More generally, even when moral thinking appears to appeal to specific religious values, it may actually be a by-product of automatically activated emotional responses – such as disgust – that evolved for reasons entirely independent of their cultural consequences (Haidt 2001).

These and other examples suggest that one of the defining features of any culture – its sharedness across a population – can emerge simply from the fact that people share a common cognitive architecture. Widespread cultural beliefs can be evoked by cognition, even in the absence of persuasion, socialization, or other acts of interpersonal information transmission (Tooby & Cosmides 1992). This insight is important, and it surely appeals to our very human preference for parsimony.

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But wait a minute; not so fast. Any pared-down, parsimonious approach to culture leaves out too much reality. The fact is that people do talk. It is one of our most prototypically human attributes. Our proclivity for communication was surely adaptive for very specific reasons that have nothing to do with the creation and perpetuation of culture (e.g., Dunbar 1996). And yet, inevitably, our tendency to talk has unintended cultural consequences. Research on *dynamic social impact* reveals how seemingly trivial acts of interpersonal communication, repeated across time and social space, create the rudimentary outlines of culture within any human population (Harton & Bourgeois 2004; Latané 1996). Other research shows that the mere act of communication influences stereotypic beliefs about the populations with which we self-identify – thus creating and perpetuating socially shared perceptions of what "our" culture is like (Kashima & Kostopoulos, in press). These and other lines of work (e.g., Boster 1991; Sperber 1990) reveal the very real and relentless role that communication plays in the creation and perpetuation of truly cultural systems of belief or behavior.

Communication is not independent of cognition, of course. Just as a purely cognitive approach to culture is too parsimonious to be true, any communication-based approach to culture is incomplete without a close consideration of the evolved cognitive mechanisms that may influence acts of communication. I suspect that the evolutionary landscape of culture will be most completely mapped by theoretical perspectives that explicitly consider the causal links between evolution, cognition, and interpersonal communication – and that chart specific ways in which communication translates evolved psychological canals into cultural beliefs.

Thus far, this kind of mapping remains rudimentary. Within the recent literature on experimental psychology, though, there are a number of intriguing findings that bear on the complex chain of events that connects evolution, cognition, communication, and culture.

For example, Schaller and Conway (1999) found that individuals' desire to impress others (a goal linked to the fundamentally adaptive need for belongingness) influenced their decisions to talk about certain kinds of topics rather than others; and these communication decisions predictably influenced the contents of emerging socially shared beliefs. Thus, the specific nature of a socially shared belief emerged as an unintended artifact of a more mercenary human motive. This group-level outcome was largely dependent on actual interpersonal communication; it was not evoked in the absence of this opportunity for unintended mutual influence.

Another example pertains to the role of emotions in predicting the popularity of "urban legends" (Heath et al. 2001). There exist hundreds of these apocryphal stories. Most are consigned quickly to the dust-bin of unpopular obsolescence, but some become well-known and linger in popular cultural memory. What predicts popularity? Heath et al. found that an urban legend becomes more popular if it more strongly triggers evolutionarily fundamental self-protective emotions, such as disgust. This process depends on interpersonal transmission. Successful stories succeed (and so become cultural) not merely because their emotional resonance makes them memorable, but because it makes them communicable.

A third – and especially promising – example explicitly marries the logical tools of evolutionary psychology to the communication-based framework of dynamic social impact theory (Kenrick et al. 2003). Some cultural systems (such as those pertaining to courtship and mating systems) are the result of a sort of implicit interpersonal negotiation between individuals with different kinds of evolved priorities. The eventual impact of evolved cognitive canals on cultural structures emerges nonlinearly, and can take on forms that are surprising from the perspective of any purely individual-level analysis of cognitive predispositions. The message of this *dynamical evolutionary psychology* is clear: The causal influence of individuals' thoughts on collective outcomes is complex and highly dynamic – and cannot be accurately predicted without models that identify specific ways in which individuals' evolved inclinations are communicated interpersonally.

These and other examples address many different kinds of social norms and cultural belief systems. It is likely that religious beliefs too are fundamentally influenced not only by the predictable ways in which we think, but also by the predictable ways in which we talk. An evolutionary analysis of religion – and an evolutionary analysis of culture more generally – will be most complete and compelling when canals of cognition are considered in conjunction with the unstoppable consequences of communication.

Is religion adaptive?

Richard Sosis and Candace Alcorta

Department of Anthropology, University of Connecticut, Storrs, CT 06269-2176. **richard.sosis@uconn.edu** **candace.alcorta@uconn.edu**
http://www.anth.uconn.edu/faculty/sosis/

Abstract: We argue that religious ritual's ability to facilitate communication and the pervasiveness of its basic characteristics across societies, as well as its precedence in other social species, suggests that religious behavior is more than a mere by-product. Religious constructs constitute associationally conditioned mnemonics that trigger neuroendocrine responses which motivate religious behaviors. The adaptive value of these constructs resides in their utility as memorable and emotionally evocative primes.

Integrating cognitive and behavioral approaches to the evolutionary study of religion is vital to our progress in understanding religious behaviors and supernatural beliefs. We applaud Atran & Norenzayan's (A&N's) efforts toward laying the groundwork for this endeavor. Although we appreciate their theoretical and experimental contributions, we are troubled by their assertion that religious behavior is not adaptive, despite failing to test any adaptive hypotheses.

Before turning to a discussion of the adaptive nature of religion, we wish to correct A&N's claim that commitment theories cannot distinguish between secular and religious ideologies. More than 30 years ago Rappaport (1971) offered an insightful analysis of why secular rituals and ideologies were less potent at generating trust and commitment than their religious counterparts. Briefly, he argued that religious rituals provide more stable referents than those of secular rituals because religious rituals sanctify unfalsifiable postulates that are beyond the vicissitudes of examination. The ability of religious rituals to evoke enduring emotional experiences differentiates them from both animal and secular rituals and lies at the heart of their efficacy in promoting and maintaining long-term group cooperation and commitment. More recently, Sosis and colleagues' evaluation of Irons' (2001) theory of religion as a hard-to-fake signal of commitment has explicitly made use of the distinction between religious and secular groups (Sosis 2000; 2003; Sosis & Bressler 2003), including research on Israeli kibbutzim (Sosis & Ruffle 2003) that specifically evaluated the differences between "Marxism and monotheism."

A&N's claim that religion constitutes a "converging by-product of several cognitive and emotional mechanisms that evolved for mundane adaptive tasks" (sect. 1, para. 3), is consistent with accumulating neuroscience research that suggests that a number of nuclei and cortices of the brain interact to generate the affect, cognition, and somatic states of religious belief and practice. Predominant among these are the hypothalamus, amygdala and cingulate cortex, hippocampus, and prefrontal cortex. However, the assertion that the cognitive and emotional mechanisms that produce religious behaviors did not evolve for such purposes, a position we are in agreement with, does not exclude the possibility that religious behaviors are adaptive. As Atran (2002a) has previously noted, the co-opting of pre-existent structures for novel solutions to ecological challenges is a hallmark of evolutionary adaptation.

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